# Attachment 9: Water Quality and Other Expected Benefits

**Expected Benefits.**
This project will prevent 5.9 million gallons of runoff from carrying sediments and pollutants into the Yuba River, contributing to peak erosive flows and increasing the danger of flooding downstream. Rain gardens, vegetated swales, and constructed wetlands, such as those proposed here, restore a more natural hydrology to rivers by sustaining base flows during dry periods, reducing water temperatures, minimizing erosion and sedimentation, and reducing nutrient and other pollutant loads. This strategy is critical to reducing downstream flood risk, ensuring a healthy riparian environment, and providing clean water for downstream use.

The benefits discussed below have been well documented in the literature as well as in studies conducted by the EPA, American Rivers, The Center for Neighborhood Technology. In addition, to reducing polluted stormwater, these practices also positively impact energy consumption, air quality, carbon sequestration, property prices and recreation. Moreover, green infrastructure practices provide flexibility to communities faced with the need to adapt infrastructure to a changing climate. Although valuation of green infrastructure monetary benefits has advanced considerably in recent years, it is still a developing field. The EPA publication *Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices* (2007) documented the comparative construction costs of green infrastructure practices in residential construction, but did not explore performance benefits. While numerous published studies address either the benefits coming from one type of practice, such as energy implications of green roofs, such studies have not achieved a cumulative assessment of multiple benefits.

Groundwater Recharge
LID practices infiltrate runoff and recharge groundwater (EPA, 2007). See Attachment 7 for an in-depth discussion of impervious cover and increased recharge in Nevada County and the CABY IRWMP region.

Water shortages nationwide increasingly indicate the need for water resource management strategies, such as those included in this project, which are designed to integrate stormwater, drinking water, and wastewater programs to maximize benefits and minimize costs. In addition, as the Sierra snowpack melts earlier and earlier in the season, it is increasingly important to slow runoff and promote alternative solutions to storing groundwater high in the headwaters. Groundwater recharge in the project area has not been characterized due to the nature of the fractured granite that characterizes the CABY region.

Water Quality Improvement and Reduced Treatment Costs
Reduced pollutant loads in will improve habitat for aquatic and terrestrial wildlife, including special status riparian and aquatic species (EPA 2009). Cleaner water will also enhance recreational uses and reduce treatment costs (EPA, 2007).

By capturing and filtering stormwater runoff, this project is expected to have the following water quality benefits:

- Reduced pollutants. Parking lot runoff, especially first-flush storm events contribute significant amounts of pollutants including: heavy metals, oils, nutrients, and sediment.

- Reduced water temperatures. Stormwater infiltration increases baseflows, providing a cool source of streamflow in late season. Infiltration is quantified in detail in Attachment 8.
- Reduced sediment. Sediment carried by parking lot runoff will be trapped and prevented from entering the Yuba River. In addition reduced peak flows high in the watershed will cause less erosion and less entrained sediment (see Attachment 7 for quantified reductions in flood flow).

Water quality benefits will be quantified through monitoring activities that are part of the project tasks (see Attachment 3 Work Plan and Attachment 6 Monitoring and Performance Measures).

These benefits are limited with a small demonstration project; however, they would have a large impact once the project's full goal is reached and stormwater projects proliferate across the CABY IRWMP region, and eventually the upper watersheds of the Sierra. This demonstration project will be the first in the CABY region and one of the first in the Sierra foothills. Phase I generated substantial interest and has already educated thousands of homeowners and contractors in its first year. The next phase will greatly increase the overall project's impact, both locally, and regionally.

Habitat Improvements

The Yuba River Watershed is home to significant and endangered species, including fall and spring-run Chinook salmon, California red-legged frog, foothill and mountain yellow-legged frog and western pond turtle. Innovative stormwater management techniques such as those we propose can improve natural resources and wildlife habitat through the improvement of water quality, regulation of water temperature, and the restoration of a more natural hydrograph. In addition, rain gardens provide habitat refugia within parking lots. For example, kildeer nested in two of the three rain gardens at the Rood Center in 2010, and the native plants and trees provide habitat for birds and insects.

Aesthetic Value

The green infrastructure components included in this proposal will not only be effective at capturing and treating runoff, they will also be quite beautiful. The rain gardens and vegetated swales will burst with plant life, including native trees, shrubs, and flowers. These components are indeed "infrastructure" but are not marred by the usual gray infrastructure characteristics of metal and concrete. While this benefit is not currently quantifiable for green infrastructure, Smart Money (2003) reports that landscaping increases home value by 11 percent and property values increase with proximity to green space.

Additional Vegetative Cover and Water Supply Treatment Cost

The Trust for Public Land noted Atlanta's tree cover has saved more than $883 million by preventing the need for stormwater retention facilities. A study of 27 water suppliers conducted by the Trust for Public Land and the American Water Works Association (2004) found a direct relationship between vegetative cover in a watershed and water supply treatment costs. This project will ensure the installation of vegetated areas on sites that would otherwise be covered by impervious pavement or barren areas that would potentially exacerbate sedimentation in the adjacent waterways.

Public Spaces, Quality of Life, and Public Participation

Both of the project sites are located in areas that will be frequented by large numbers of people. In fact, the Rood Center is one of the most-frequented locations in Nevada County.

Our project will not only enhance public awareness of green infrastructure, stormwater management, water quality, and other issues, it will also provide an avenue for public participation, information sharing, and the enjoyment of beautiful public spaces. As part of this project demonstration and public outreach days have and will be planned, and stormwater monitoring and management will be part of the YRCS science curriculum.

Enhanced Human and Social Capital

This project includes components that would increase the amount of information available to residents, developers, water-system operators, and many others regarding the benefits of green infrastructure stormwater facilities. This project also includes outreach and education activities that would engage community members, water managers, IRWMP participants, and other stakeholders. These experiences would increase the human and social capital in the region insofar as they educate the local population and/or build social ties within the community. Human and social capital are valuable in that they enhance the capacity of community members to engage in and complete future projects and are more effectively able to respond to critical issues the region is likely to face as climate change and population growth continue to put pressure on its already scarce resources.

Data are unavailable to quantify the economic benefits arising from these effects, but they could lead to lower costs of stormwater management facilities, increases in groundwater recharge, and improvements in water quality and habitat, as projects such as this proliferate across the CABY region and beyond.

Public Education

The USEPA (2008) has listed public education as one of its six stormwater best management practices, further supporting the need for communities to be educated about water conservation and stormwater management. This is particularly important given the public's lack of understanding about the primary causes of and solutions to water pollution problems. A 2005 report by the National Environmental Education & Training Foundation (NEEFT) came to the following conclusion: "78 percent of the American public does not understand that runoff from agricultural land, roads, and lawns, is now the most common source of water pollution; and nearly half of Americans (47 percent) believes industry still accounts for most water pollution (NEEFT 2005)."

While quantifying and valuing public education is difficult, educating and informing the general public about the efficient use of water resources is a valuable service that can build support for better water management decisions in the future. It is a vital precursor to achieving widespread adoption of green infrastructure solutions and realizing the many benefits they offer to communities.

Local, Regional, and Statewide Benefits

The residents of the Yuba River Watershed, the CABY region, and the Sierra Nevada will benefit from the implementation of this project. Additionally, developers and other similar stakeholders in the region will benefit from highly applicable information. Water system operators and state regulators, including DWR, could also experience reduced treatment, infrastructure improvement, and regulatory or enforcement costs as a result of this project. This project will also result in an increase in local capacity to effectively address stormwater-related issues, reducing the need for intervention or regulation. The benefits will be received upon completion of the project.